

Background Paper on the Hanford Reach National Monument

This document was provided by the White House on the date the President signed the Proclamation.

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THE ANTIQUITIES ACT

Section 2 of the Antiquities Act, 16 U.S.C. 431, authorizes the President to establish as national monuments “historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest that are situated upon the lands owned or controlled by the Government of the United States....”

A. Objects of Historic or Scientific Interest

The Hanford Reach National Monument is a unique and biologically diverse landscape, encompassing an array of scientific and historic objects. This magnificent area contains an irreplaceable natural and historic legacy, preserved by unusual circumstances. Maintained as a buffer area in a Federal reservation conducting nuclear weapons development and, more recently, environmental cleanup activities, with limits on development and human use for the past 50 years, the monument is now a haven for important and increasingly scarce objects of scientific and historic interest. Bisected by the stunning Hanford Reach of the Columbia River, the monument contains the largest remnant of the shrub-steppe ecosystem that once blanketed the Columbia River Basin. The monument is also one of the few remaining archaeologically rich areas in the western Columbia Plateau, containing well-preserved remnants of human history spanning more than 10,000 years. The monument is equally rich in geologic history, with dramatic landscapes that reveal the creative forces of tectonic, volcanic, and erosive power.

The monument is a biological treasure, embracing important riparian, aquatic, and upland shrub-steppe habitats which are rare or in decline in other areas. Within its mosaic of habitats, the monument supports a wealth of increasingly uncommon native plant and animal species, the size and diversity of which is unmatched in the Columbia Basin. Migrating salmon, birds and hundreds of other native plant and animal species rely on its natural ecosystems.

¹The boundaries of the monument are drawn on the map entitled "Hanford Reach National Monument." The BLM will produce a description conforming to the BLM Specifications for Descriptions of Tracts of Land for Use in Land Orders and Proclamations as soon as practicable.

The monument includes the 51-mile long “Hanford Reach,” the last free-flowing, non-tidal stretch of the Columbia River. The Reach contains islands, riffles, gravel bars, oxbow ponds, and backwater sloughs that support some of the most productive spawning areas in the Northwest, where approximately 80 percent of the upper Columbia Basin’s fall chinook salmon spawn. It also supports healthy runs of naturally-spawning sturgeon and other highly-valued fish species. The loss of other spawning grounds on the Columbia and its tributaries has increased the importance of the Hanford Reach for fisheries.

The monument contains one of the last remaining large blocks of shrub-steppe ecosystems in the Columbia River Basin, supporting an unusually high diversity of native plant and animal species. A large number of rare and sensitive plant species are found dispersed throughout the monument. A recent inventory resulted in the discovery of two plant species new to science, the Umtanum desert buckwheat and the White Bluffs bladderpod. Fragile microbiotic crusts, themselves of biological interest, are well developed in the monument and play an important role in stabilizing soils and providing nutrients to plants.

The monument contains significant breeding populations of nearly all steppe and shrub-steppe dependent birds, including the loggerhead shrike, the sage sparrow, the sage thrasher, and the ferruginous hawk. The Hanford Reach and surrounding wetlands provide important stop-over habitat for migratory birds, as well as habitat for many resident species. The area is important wintering habitat for bald eagles, white pelicans and many species of waterfowl such as mallards, green-winged teal, pintails, goldeneye, gadwall, and buffleheads. The monument’s bluff habitats provide valuable nesting sites for several bird species, including prairie falcons, and important perch sites for raptors such as peregrine falcons.

Many species of mammals are also found within the monument, including elk, beaver, badgers, and bobcats. Insect populations, though less conspicuous, include species that have been lost elsewhere due to habitat conversion, fragmentation and application of pesticides. A recent biological inventory uncovered forty-one species, and two subspecies of insects new to science and many species not before identified in the state of Washington. Such rich and diverse insect populations are important to supporting the fauna in the monument.

In addition to its vital biological resources, the monument contains significant geological and paleontological objects. The late-Miocene to late-Pliocene Ringold Formation, known as the White Bluffs, was formed from river and lake sediments deposited by the ancestral Columbia River and its tributaries. These striking cliffs form the eastern bank of the Columbia for nearly half of the length of the Reach, and are significant for the mammalian fossils that they contain. Fossil remains from rhinoceros, camel, and mastodon, among others, have been found within these bluffs.

The Hanford Dune Field, located on the western shore of the Columbia in the southeastern part of the monument, is also of geologic significance. This active area of migrating barchan dunes and

partially stabilized transverse dunes rises ten to sixteen feet above the ground, creating sandy habitats ranging from two to several hundred acres in size.

The monument also contains important archaeological and historic information. More than 10,000 years of human activity in this largely arid environment have left extensive archaeological deposits. Areas upland from the river show evidence of concentrated human activity, and recent surveys indicate extensive use of arid lowlands for hunting. Hundreds of prehistoric archaeological sites have been recorded, including the remains of pithouses, graves, spirit quest monuments, hunting camps, game drive complexes, quarries, and hunting and kill sites. A number of Native American groups still have cultural ties to the monument. The monument also contains some historic structures and other remains from more recent human activities, including homesteads from small towns established along the riverbanks in the early 20th century.

The area in the monument was identified for preservation by the U.S. Department of Energy (DOE) in its November of 1999 Record of Decision adopting the Preferred Alternative in the Final Hanford Comprehensive Land-Use Plan EIS issued in September of 1999. Specific portions of this land are already subject to agreements that provide the U.S. Fish and Wildlife Service (FWS) with the responsibility to protect the wildlife and other natural resources. These lands are managed by the FWS under permits and agreements with the DOE. Currently, the FWS manages the 89,000 acre Wahluke Slope area under a 1971 permit from the DOE. The FWS also manages the 77,000 acre Arid Lands Ecology Reserve Unit under a 1997 permit from the DOE.

B. Land Area Reserved for the Proper Care and Management of the Objects to be Preserved.

The Antiquities Act authorizes the President, as part of his declaration of a national monument, to reserve land, "the limits of which in all cases shall be confined to the smallest area compatible with the proper care and management of the objects to be protected...." 16 U.S.C. § 431. The area for reservation has been carefully delineated, based on review of available information, to meet the goals of effectively caring for and managing the objects in perpetuity.

The area includes the biological, geological, and historic objects identified in the proclamation and Attachment A accompanying this memorandum. The area of the monument is based on the conservation needs of the objects to be protected. Some of these objects, such as the biological resources, are present throughout the entire monument area. Others, such as the historic sites, are confined to smaller areas. The scientific value of many objects, including the biological resources, derives in part from their location at various sites or elevations throughout the monument.

Preservation of such objects requires, among other things, protection of enough land to maintain the conditions that have made their continued existence possible. The scientific value of many of the objects within the monument requires preservation of areas large enough to maintain the objects and their interactions. The biological objects in the area result from the fact that extensive sections of the Columbia Basin shrub-steppe ecosystem have been preserved by the lack of

development and land conversion on the Hanford site. Many species must range within and through the area to maintain viable populations and their role in the ecosystem. This is especially important because of the loss of the shrub-steppe ecosystem and aquatic habitat in other parts of the Columbia Basin. Management of a patchwork of reserved lands would be impractical, as it would make it more difficult to care for the objects, reduce options for natural resource management and lead to inconsistent resource management standards for overlapping resources. For these reasons, the reservation of a smaller area would undermine the proper care and management of the objects to be protected by the monument.

LEGAL EFFECTS OF THE PROCLAMATION

There are several significant aspects of the proclamation. First, it reserves only the federal lands in the area, because the Antiquities Act applies only to objects of historic or scientific interest “that are situated upon the lands owned or controlled by the Government of the United States.” 16 U.S.C. § 431.

Second, the proclamation is subject to valid existing rights. Thus, to the extent a person or entity has valid existing rights in the federal lands or resources within the area, the proclamation respects those rights. The exercise of such rights could, however, be regulated in order to protect the purposes of the monument.

Third, the proclamation appropriates and withdraws the federal lands and interests in lands within the boundaries of the monument from entry, location, sale, leasing or other disposition under the public land laws, including but not limited to withdrawal from location, entry, and patent under the mining laws and from disposition under all laws relating to mineral and geothermal leasing, other than by exchange that furthers the protective purposes of the monument. This withdrawal prevents the location of new mining claims under the 1872 Mining Law, and prevents the Secretary of the Interior from exercising discretion under the mineral leasing acts and related laws to lease or sell federal minerals within the boundaries of the monument.

Fourth, the proclamation reserves in the portion of the Columbia River within the boundaries of the monument, subject to valid existing rights and as of the date of the proclamation, sufficient water to fulfill the purposes for which the monument is established.

Fifth, nothing in the proclamation revokes any existing withdrawal, reservation, or appropriation; however, the national monument shall be the dominant reservation. Therefore, the federal agencies with existing management responsibilities for the land within the monument boundaries will continue to have such responsibilities, subject to the dominant reservation, as provided for in the proclamation. The reference in the proclamation to the national monument being the dominant reservation makes clear that, in the event of a conflict between this reservation and an existing withdrawal, reservation or appropriation, this reservation controls. The particular

provisions of this proclamation, such as the specific reservations of rights and responsibilities of the Department of Energy, are part of this monument reservation.

Sixth, nothing in the proclamation interferes with the operation and maintenance by the Bureau of Reclamation of existing Columbia Basin Reclamation Project facilities located within the monument; however, the monument designation precludes new agricultural irrigation within the boundaries.

Seventh, nothing in the proclamation interferes with the operation and maintenance of the Federal Columbia River Transmission System, or other utility services located within the monument.

Eighth, nothing in the proclamation affects DOE's authority to manage lands within the monument as necessary to carry out the environmental cleanup mission or other environmental compliance within the monument. This includes the right to regulate or restrict public access, maintain security, impose safety requirements, install and maintain environmental monitoring facilities, and implement emergency preparedness. Such matters remain the responsibility of DOE. Likewise, nothing in the proclamation affects the DOE's responsibility under environmental laws including the remediation of hazardous substances or the restoration of natural resources injured by hazardous substances on monument lands. Nothing in the proclamation imposes any liability upon the Department of the Interior for the remediation of hazardous substances or the restoration of natural resources at the Hanford facility except as provided in agreements, including permits, between the DOE and the Department of the Interior, nor transfer to the Department of the Interior any of the DOE's responsibility to take measures for environmental remediation, monitoring, security, safety or emergency preparedness purposes. Further, nothing in the proclamation imposes any limitations or restrictions on the DOE activities conducted upon lands that are not included in the monument.

ADMINISTRATION OF THE MONUMENT

A. Management of the monument

The federal lands in the area described in the proclamation are currently under the jurisdiction of the U.S. Bureau of Land Management (BLM), the U.S. Bureau of Reclamation (BOR), and the U.S. Department of Energy (DOE). In addition to acquiring privately held land, the DOE created the Hanford Site by withdrawing public land and entering into an agreement with the Bureau of Reclamation to obtain management responsibility for certain withdrawn and acquired lands held by Reclamation as part of the Columbia Basin Project, north of the Columbia River. The DOE has a similar arrangement with the Bureau of Land Management. The FWS manages some of the lands within the monument area under permits and agreements with the Department of Energy. For example, in the Wahluke Slope Area, the Saddle Mountain National Wildlife Refuge was created by the terms of a 1971 permit with the DOE; this Refuge includes land acquired by the Bureau of Reclamation land and managed by the DOE as part of the Hanford Site. These arrangements are not altered by the proclamation, but all agreements should be reviewed to

ensure consistency with the proclamation. The FWS and the DOE are expected to extend the agreements to other lands included in the monument that are not now managed by FWS.

The DOE manages the Hanford site pursuant to the Atomic Energy Act of 1954, as amended, and applicable Public Land Orders. The BLM manages public lands pursuant to its organic authorities, primarily the Federal Land Policy and Management Act of 1976 (FLPMA), 43 U.S.C. § 1702 et seq. The BOR holds lands for the Columbia Basin Project Act under that project's authorizing statute, at 16 U.S.C. § 835c, as amended. The FWS manages lands under its management jurisdiction pursuant to the National Wildlife Refuge System Administration Act, 16 U.S.C. § 668dd-ee, and in accordance with agreements with DOE.

The proclamation directs the Secretary of the Interior to manage the monument through the FWS under its existing authorities and existing agreements with the DOE, and under future agreements with the DOE as lands within the monument subject to the DOE cleanup responsibilities are determined by the DOE and the FWS to be suitable for transfer of management responsibility. The DOE will manage lands within the monument that are not subject to management agreements with the FWS (primarily the land bordering the south side of the Hanford Reach) under its existing authorities and consistent with the purposes of the monument.

B. Impact of monument designation on existing or planned activities in the area

1. Hazardous waste clean-up and restoration

The monument designation has no effect on hazardous waste clean-up or restoration of natural resources, as provided for in the eighth paragraph in the section on Legal Effects of the Proclamation, above. The DOE continues to be responsible for the clean up of hazardous waste and for any related restoration of natural resource injuries, except as provided in agreements, including permits, between the DOE and the Department of the Interior. Cleanup decisions by the DOE will continue to be coordinated with the appropriate federal and state regulatory agencies. Restoration of any injured natural resources will continue to be the responsibility of the DOE. Cleanup and restoration activities should be planned and accomplished in a cooperative manner among the agencies to facilitate the determination that specific areas are suitable for transfer of management responsibility to the FWS.

2. Agricultural activities

No grazing currently occurs within the monument boundaries. Therefore, the prohibition on grazing included in the proclamation does not change the status quo. The DOE has issued a license (#R006-94LI12799.000) to the S. Martinez Livestock Inc. for a road right of way to herd livestock across the monument along what is commonly known as the Wanapum Road. This license is a valid existing right that is protected by the preservation of valid existing rights in the proclamation.

3. Recreation, hunting, fishing and similar activities

Much of the monument has been off limits to recreation and public access. However, wildlife dependent recreation (hunting, fishing, environmental education, wildlife observation, interpretation, and photography) does occur on the Wahluke Wildlife Recreation Unit on the Wahluke Slope. Such recreation would generally not be affected except where (1) the land managing agency, through processes required by existing law, identifies places where such uses ought to be restricted or prohibited as necessary to protect the federal lands and resources, including the objects protected by the monument designation; or (2) where the agency finds a clear threat from such a use to the federal lands and resources, including the objects protected by the monument designation, and the circumstances call for swift protective action. Such uses remain subject to applicable laws and regulations, and therefore remain subject to regulation and limitation under such provisions for reasons other than establishment of the monument.

4. Use of existing rights-of-way (such as those established under Title V of FLPMA)

Use of existing rights-of-way would generally be subject to the same standards as described in the preceding section. Some existing rights-of-way may include valid existing rights. The exercise of such rights may be regulated in order to protect the purposes of the monument, but any regulation must respect such rights.

5. Access

For purposes of protecting the objects identified in the proclamation, it prohibits motorized and mechanized vehicle travel off road, except for emergency purposes, or other federally authorized purposes. The Department of Energy retains its authority to control access to the Monument for security, safety or emergency preparedness purposes. Because of the very limited public access to the site, off road vehicle use is already limited.

6. Mineral activities

Although exploration for gas has occurred in the area, deposits have proven to be small. Oil exploration was conducted in the Rattlesnake Mountain and Rattlesnake Hills area in the 1920s and 1930s, but useful deposits were not found. Big Bend Alberta Mining Company asserts an interest in minerals on approximately 1,200 acres within the monument. To the extent that rights exist, they would be treated as valid existing rights.

7. Indian Rights

To the extent that Indian Tribes have rights pursuant to the Stevens Treaties of 1855 or any other federal law, those rights would be unaffected.

8. Hydroelectric Operations

Instream flows in this stretch of the Columbia River are governed by the terms of the “Vernita Bar agreement” (agreement). That agreement, among several public utility districts, federal agencies and Indian tribes, provides an instream flow regime to protect salmon. Nothing in the proclamation abrogates the agreement.

9. Bonneville Power Administration

The Bonneville Power Administration (BPA) operates the Federal Columbia River Transmission System, which is partially located within the monument. The System is important to the Pacific Northwest, and includes facilities in and around the monument. BPA has in various planning stages a number of projects to upgrade and expand transmission facilities that could be affected by the proposed monument, including rebuilding the Benton-Franklin Nos. 1 and 2 115 kilovolt (KV) transmission lines, and building a new 500 KV transmission line to parallel an existing (Schultz-Vantage-Hanford) 500 KV line. Nothing in the proclamation interferes with the operation and maintenance of the Federal Columbia River Transmission System located within the monument. Replacement, modification and expansion of existing Federal Columbia River Transmission System facilities, and construction of any new facilities, within the proposed monument, as authorized by other applicable law, may be carried out in a manner consistent with the proper care and management of the objects identified in the draft proclamation, as determined in accordance with the management arrangements set out in the draft proclamation.

Attachment: Hanford Reach Bibliography

Hanford Reach Bibliography

Adams, M.J., K.O. Richter, and W.P. Leonard, 1997. "Surveying and Monitoring Pond-Breeding Amphibians Using Aquatic Funnel Traps," in Olson, D.H., W.P. Leonard and R.B. Bury, "Sampling Amphibians in Lentic Habitats of the Pacific Northwest," *Northwest Fauna*, 4:47-54.

Andelman, S.J., and A. Stock, 1994. *Management, Research and Monitoring Priorities for the Conservation of Neotropical Migratory Landbirds that Breed in Washington State*. Washington Natural Heritage Program, Washington Department of Natural Resources, Olympia, Washington.

American Ornithologists Union (AOU), 1983. *Check-List of North America Birds*, 6th edition. AOU, Washington, D.C.

Battelle (Pacific Northwest National Laboratory), 1976. *Final Report on Aquatic Ecological Studies Conducted at the Hanford Generating Project, 1973-74*. Washington Public Power Supply System (WPPSS) Columbia River Ecology Studies, Vol. 1.

Battelle (Pacific Northwest National Laboratory), 1977. *Aquatic Ecological Studies Near WNP-1, 2 and 4, October 1975 through February 1976*. WPPSS Columbia River Ecology Studies, Vol. 3.

Battelle (Pacific Northwest National Laboratory), 1978. *Aquatic Ecological Studies Near WNP-1, 2 and 4, March through December 1976*. WPPSS Columbia River Ecology Studies, Vol. 4.

Battelle (Pacific Northwest National Laboratory), 1979a. *Aquatic Ecological Studies Near WNP-1, 2 and 4, September 1974 through September 1975*. WPPSS Columbia River Ecology Studies, Vol. 2. Pacific Northwest Laboratory, Richland, Washington.

Battelle (Pacific Northwest National Laboratory), 1979b. *Aquatic Ecological Studies Near WNP-1, 2, and 4, January through December 1977*. WPPSS Columbia River Ecology Studies, Vol. 5.

Battelle (Pacific Northwest National Laboratory), 1979c. *Aquatic Ecological Studies Near WNP-1, 2 and 4, January through August 1978*. WPPSS Columbia River Ecology Studies, Vol. 6.

Battelle (Pacific Northwest National Laboratory), 1998. *Hanford Site National Environmental Policy Act (NEPA) Characterization*. PNNL-6415 Rev.10. Battelle, Richland, Washington.

Beak Consultants Inc., 1980. *Aquatic Ecological Studies Near WNP-1, 2 and 4, August 1978-March 1980*. WPPSS Columbia River Ecology Studies, Vol. 7. Prepared for Washington Public Power Supply System by Beak Consultants Inc., Portland, Oregon.

Becker, C.D., 1990. *Aquatic Bioenvironmental Studies: The Hanford Experience 1944-84*. Elsevier, Amsterdam, Netherlands.

Becker, J.M., 1993. *A Preliminary Survey of Selected Structures on the Hanford Site for Townsend's Big-Eared Bat (Plecotus townsendii)*. PNL-8916, Pacific Northwest Laboratory, Richland, Washington.

Betts, B.J., 1990. "Geographic Distribution and Habitat Preferences of Washington Ground Squirrels (*Spermophilus washingtoni*)," *Northwestern Naturalist*, 71:27-37.

Bourgeron, P.S., R.L. DeVelie, L.D. Engelking, G. Jones, and E. Muldavin, 1992. *WHTF Site and Community Survey Manual*. Version 92B. Western Heritage Task Force, Boulder, Colorado.

Brotherson, J.D., and S.B. Rushforth, 1983. "Influence of Cryptogamic Crusts on Moisture Relationships of Soils in Navajo National Monument, Arizona," *Great Basin Naturalist*, 43:73-78.

Burch, J.B., 1972. *Freshwater Sphaeriacean Clams (Mollusca: Pelecypoda) of North America*. Environmental Protection Agency, Biota of Freshwater Ecosystems, Identification Manual No. 3.

Cadwell, L.L., 1994. *Wildlife Studies on the Hanford Site: 1993 Highlights Report*. PNL-9380, Pacific Northwest Laboratory, Richland, Washington.

Caplow, F.E., and K.A. Beck, 1994. *A Rare Plant Survey of the Hanford Nuclear Reservation*. Report to The Nature Conservancy of Washington.

Caplow, F.E., and K.A. Beck, 1996. *A Rare Plant Survey of the Hanford Nuclear Reservation*. Report to The Nature Conservancy of Washington.

Caplow, F.E., and K.A. Beck, 1997. *A Rare Plant Survey of the Hanford Nuclear Reservation: The Hanford Biodiversity Project*. Report to The Nature Conservancy of Washington.

Cardenas, J. Lewinsohn, C. Auger, J.L. Downs, L.L. Cadwell, and R. Burrows, 1997. *Characterization of a Sagebursh (Artemisia tridentata ssp. wyomingensis) Die-off on the Hanford Site*. PNNL-11700, Pacific Northwest National Laboratory, Richland, Washington.

Carlson, L., G. Geupel, J. Kjelson, J. MacKivor, M. Morton, and N. Shishido, 1980. "Geographic Range, Habitat Requirements, and a Preliminary Population Study of *Spermophilus washingtoni*," Final Technical Report (unpublished), National Science Foundation Student Originated Studies Program Grant SMI 5350.

Clark, A.H., 1973. "The Freshwater Molluscs of the Canadian Interior Basin," *Malacologia*, 13.

Cline, J.F., D.W. Uresk, and W.H. Rickard, 1977. "Plants and Soil of a Sagebrush Community on the Hanford Reservation," *Northwest Science*, 51:60-70.

Curdy, Jim (ed.), [no date]. *Columbia River Treaty Documents*. Mattawa, Washington.

Cushing, C.E. (ed.), 1994. *Hanford Site National Environmental Policy Act (NEPA) Characterization*. PNL-6415, Rev. 6, Pacific Northwest Laboratory, Richland, Washington.

Cushing, C.E. (ed.), 1995. *Hanford Site National Environmental Policy Act (NEPA) Characterization*. PNL-6415, Rev. 7, Pacific Northwest Laboratory, Richland, Washington.

Daubenmire, R., 1970. *Steppe Vegetation of Washington*. Washington Agricultural Experiment Station, Technical Bulletin 62, Pullman, Washington.

Davis, J.J., and C.L. Cooper, 1951. *Effect of Hanford Pile Effluent Upon Aquatic Invertebrates in the Columbia River*. Document No. HW-20055, Battelle Northwest. U.S. Atomic Energy Commission, Hanford Works, Richland, Washington, Operated by General Electric Company.

Dobler, F.C., 1992. *The Shrub Steppe Ecosystem of Washington: A Brief Summary of Knowledge and Nongame Wildlife Conservation Needs*. Shrub Steppe Ecosystem Project, Washington Department of Wildlife, Olympia, Washington.

Downs, J.L., W.H. Rickard, C.A. Brandt, L.L. Cadwell, C.E. Cushing, D.R. Geist, R.M. Mazaika, D.A. Neitzel, L.E. Rogers, M.R. Sackschewsky, and J.J. Nugent, 1993. *Habitat Types on the Hanford Site: Wildlife and Plant Species of Concern*. PNL-8942, Pacific Northwest Laboratory, Richland, Washington.

Duberstein, C.A., 1997. *Use of Riparian Habitats by Spring Migrant Landbirds in the Shrub Steppe of Washington*. M.S. Thesis. Washington State University, Pullman.

Dvornich, K.M., K.R. McAllister, K.B. Aubry, 1997. *Amphibians and Reptiles of Washington State: Location Data and Predicted Distributions, Volume 2 in Washington State Gap Analysis-Final Report*. K.M. Cassidy, C.E. Grue, M.R. Smith, and K.M. Dvornich (eds.), Volumes 1-5. Washington Cooperative Fish and Wildlife Research Unit, University of Washington, Seattle.

Easterly, R., and D. Salstrom, 1998. *Central Hanford: 1997 Plant Community Inventory*. Report to The Nature Conservancy of Washington, Seattle, Washington.

Eldridge, D.J., and R.S.B. Greene, 1994. "Assessment of Sediment Yield from a Semi-arid red Earth with Varying Cover of Cryptogams," *Journal of Arid Environments*, 26:221-232.

Ennor, H.R., 1991. *Birds of the Tri-Cities and Vicinity*. Lower Columbia Basin Audubon Society, Richland, Washington.

Ensor, P., 1996. *1994-1995 Lepidoptera Inventory & Analysis at the Hanford Site*. The Nature Conservancy of Washington, Seattle, Washington.

Ensor, P., 1998. *1997 Lepidoptera Inventory & Analysis at the Hanford Site*. The Nature Conservancy of Washington, Seattle, Washington.

Evans, R.G., M.J. Hattendorf, and C.T. Kincaid, 2000. *Evaluation of the Potential for Agricultural Development at the Hanford Site*. Prepared for the U.S. Department of Energy under Contract DE-AC06-76RLO-1830, Pacific Northwest National Laboratory.

Fitch, H.S., 1987. "Collecting Techniques," in R.A. Seigel, J.T. Collins, and S.S. Novak (eds.). *Snakes: Ecology and Evolutionary Biology*. McGraw-Hill, New York.

Fitzner, R.E., and R.H. Gray, 1991. "The Status, Distribution and Ecology of Wildlife on the U.S. DOE Hanford Site: A Historical Overview of Research Activities," *Environmental Monitoring and Assessment*, 18:173-202.

Fitzner, R.E., W.H. Rickard, L.L. Cadwell, and L.E. Rogers, 1981. *Raptors of the Hanford Site and Nearby Areas of Southcentral Washington*. PNL-3212, Pacific Northwest Laboratory, Richland, Washington.

Folliard, L.B., and J.H. Larsen, Jr., 1991. *Distribution and Status of Shrub-steppe Reptiles on the Hanford Reservation (Washington State)*. Nongame Wildlife Program, Washington Department of Wildlife, Olympia, Washington.

Franklin, J.F., and C.T. Dyrness, 1973. *Natural Vegetation of Oregon and Washington*. General Technical Report PNW-8. U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

Franklin, J.F., F.C. Hall, C.T. Dyrness, and C. Maser (eds.), 1972. *Federal Research Natural Areas in Oregon and Washington: A Guidebook for Scientists and Educators*. U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

Frest, T.J., and E.J. Johannes, 1993. *Mollusc Survey of the Hanford Site, Benton and Franklin Counties, Washington*. PNL-8653, Pacific Northwest Laboratory, Richland, Washington.

Gaines, W.E., 1987a. *Secondary Production of Benthic Insects in Three Cold Desert Streams*. PNL-6286, Pacific Northwest Laboratory, Richland, Washington.

Gaines, W.E., 1987b. "Secondary Production of Benthic Insects in Three Cold Desert Streams," unpublished Masters Thesis. Central Washington University, Ellensburg, Washington.

Gano, K.A., and W.H. Rickard, 1982. "Small Mammals of a Bitterbrush-Cheatgrass Community," *Northwest Science*, 56:1-7.

Garrison, T.E., and T.L. Best, 1990. "Dipodomys Ordii," *Mammalian Species*, 353:1-10.

Gaylord, D.R., and L.D. Stetler, 1994. "Aeolian-climatic Thresholds and Sand Dunes at the Hanford Site, South-Central Washington, USA," *Journal of Arid Environments*, 28:95-116.

Gerber, M.S., 1992. *On the Home Front: The Cold War Legacy of the Hanford Nuclear Site*. University of Nebraska Press.

Gibbons, J.W., and R.D. Semlitsch, 1981. "Terrestrial Drift Fences with Pitfall Traps: an Effective Technique for Quantitative Sampling of Animal Populations," *Brimleyana*, 7: 1-16.

Greager, T., 1994. *Hanford Bird Inventory: 1994 Field Work*. Report to The Nature Conservancy of Washington, Seattle, Washington.

Greager, T., 1995. *Hanford Bird Inventory: 1995 Field Work*. Report to The Nature Conservancy of Washington, Seattle, Washington.

Greager, T., 1997. *Birds of Central Hanford: 1997*. Report to The Nature Conservancy of Washington, Seattle, Washington.

Grossman, D.H., D. Faber-Langendoen, A.W. Weakley, M. Anderson, P. Bougeron, R. Crawford, K. Goodin, S. Landaal, K. Metzler, K.D. Patterson, M. Pyne, M. Reid, and L. Sneddon, 1998 [In Press]. *International Classification of Ecological Communities: Terrestrial Vegetation of the United States, Volume II*. The Nature Conservancy, Arlington, Virginia.

Hall, J.A., 1997. *Hanford Site Biological Resources Management Plan (BRMaP) Tribal and Stakeholder Inventory and Monitoring Workshop Report: Summation and Assessment of Recommendations*. Report to Pacific Northwest National Laboratory, Richland, Washington and The Nature Conservancy of Washington, Seattle, Washington.

Hall, J.A., 1998. *Biodiversity Inventory and Analysis of the Hanford Site: 1997 Annual Report*. The Nature Conservancy of Washington, Seattle, Washington.

Hajek, B.F., 1966. *Soil Survey: Hanford Project in Benton County, Washington*. BNWL-243, Pacific Northwest Laboratory, Richland, Washington.

- Hallock, L.A., 1995. *Herpetofauna of the Hanford Nuclear Reservation*. The Nature Conservancy of Washington, Seattle, Washington.
- Hallock, L.A., 1998. *Herpetofauna of the Hanford Nuclear Reservation, Grant, Franklin and Benton Counties, Washington*. The Nature Conservancy of Washington, Seattle, Washington.
- Hanford Reach Citizens' Advisory Panel, 1999. *Hanford Reach Protection & Management Program, Interim action Plan*. A.J. Fyall, (ed.), Counties of Benton, Franklin, and Grant; Prosser, Washington.
- Harper, K.T., and R.L. Pendleton, 1993. "Cyanobacteria and Cyanolichens: Can They Enhance Availability of Essential Minerals for Higher Plants?" *Great Basin Naturalist*, 53:59-72.
- Hershler, R., and T.J. Frest, 1996. "A Review of the North American Freshwater Snail Genus *Fluminicola* (Hydrobiidae)," *Smithsonian Contributions to Zoology*, 583:1-41.
- Heyer, W.R., M.A. Donnelly, r.W. McDiarmid, L.C. Hayek, and M.S. Foster, 1994. *Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians*. Smithsonian Institutional Press, Washington.
- Hinds, N.R., and L.E. Rogers, 1991. *Ecological Perspective of Land Use History: The Arid Lands Ecology (ALE) Reserve*. PNL-7750, Pacific Northwest Laboratory, Richland, Washington.
- Hironaka, M., M. Fosberg, and A. Winward, 1983. *Sagebrush-grass Habitat Types of Southern Idaho*. Forest, Wildlife, and Range Experiment Station, University of Idaho, Moscow.
- Hitchcock, C.L. and A. Cronquist, 1973. *Flora of the Pacific Northwest*. University of Washington Press, Seattle.
- Hitchcock, C.L., A. Cronquist, M. Owenby, and J.W. Thompson, 1955-1969. *Vascular Plants of the Pacific Northwest*. Volumes 1-5. University of Washington Press, Seattle.
- Hoitink, D.J., and K.W. Burk, 1994. *Climatological Data Summary 1993 with Historical Data*. PNL-9809, Pacific Northwest Laboratory, Richland, Washington.
- Hoitink, D.J., and K.W. Burk, 1995. *Hanford Site Climatological Data Summary 1994 with Historical Data*. PNL-10553, Pacific Northwest Laboratory, Richland, Washington.
- James, M.M., and J. Soll, 1996. *Plant Communities and Cover Types of Umtanum Ridge Within the Hanford Nuclear Reservation*. The Nature Conservancy of Washington, Seattle, Washington.

Johansen, J.R., 1993. "Cryptogamic Crusts of Semi-arid Lands of North America," *Journal of Phycology*, 29:140-147.

Johansen, J.R., J. Ashley, and W.R. Rayburn, 1993. "Effects of Range Fire on Soil Algal Crusts in Semiarid Shrub-Steppe of the Lower Columbia Basin and Their Subsequent Recovery," *Great Basin Naturalist*, 53:73-88.

Johnson, C.G., and S.A. Simon, 1987. *Plant Associations of the Wallowa-Snake Province: Wallowa-Whitman National Forest* U.S. Department of Agriculture, Forest Service, Pacific Northwest Region, Wallowa-Whitman National Forest.

Johnson, R.E., and K.M. Cassidy, 1997. "Terrestrial Mammals of Washington State: Location Data and Predicted Distributions, Volume 3," in K.M. Cassidy, C.E. Grue, M.R. Smith, and

K.M. Dvornich (eds.), *Washington State Gap Analysis Final Report*. Washington Cooperative Fish and Wildlife Research Unit, University of Washington, Seattle.

Karr, J.R., 1993. "Defining and Assessing Ecological Integrity: Beyond Water Quality," *Environmental Toxicology and Chemistry*, 12:1521-1531.

LaFramboise, W., and N. LaFramboise, 1997. *Birds of the Fitzner-Eberhardt Arid Lands Ecology Reserve: 1997*. Report to The Nature Conservancy of Washington, Seattle, Washington.

LaFramboise, W., and N. LaFramboise, 1998. *Birds of the Fitzner-Eberhardt Arid Lands Ecology Reserve: 1998*. Report to The Nature Conservancy of Washington, Seattle, Washington.

Landeon, D.S., A.R. Johnson, and R.M. Mitchell, 1992. *Status of the Birds at the Hanford Site in Southeastern Washington*. WHC-EP-0402, Rev. 1. Westinghouse Hanford Company, Richland, Washington.

Marr, N.V., C.A. Brandt, R.E. Fitzner, and L.D. Poole, 1988. *Habitat Associations of Vertebrate Prey Within the Controlled Area Study Zone*. PNL-6495, Pacific Northwest Laboratory, Richland, Washington.

Marr, V., 1997. *Washington Ground Squirrel and Pygmy Rabbit Surveys, North Slope and Central Hanford Site, Washington, 1997*. The Nature Conservancy of Washington, Seattle, Washington.

McAllister, K.R., 1995. "Distribution of Amphibians and Reptiles in Washington State," *Northwest Fauna*, 3:81-112.

McCune, B., and R. Rosentreter, 1995. "Field Key to Soil Lichens of Central and Eastern Oregon," unpublished report.

- Metting, B., 1991. "Biological Surface Features of Semiarid Lands and Deserts," in J. Skujins (ed.), *Semiarid Lands and Deserts: Soil Resource and Reclamation*. Marcel Dekker, Inc., New York.
- Nagorsen, D.W. and R.M. Brigham, 1993. *The Mammals of British Columbia. 1. Bats (Chiroptera)*. Royal British Columbia Museum Handbook. Royal British Columbia Museum and University of British Columbia Press.
- Nash III, T.H., 1996a. "Nutrients, Elemental Accumulations and Mineral Cycling," in T.H. Nash III (ed.), *Lichen Biology*. Cambridge University Press, Cambridge.
- Nash III, T.H., 1996b. "Nitrogen, its Metabolism and Potential Contribution to Ecosystems," in T.H. Nash III (ed.), *Lichen Biology*. Cambridge University Press, Cambridge.
- Neitzel, D.A., and T.J. Frest, 1989. *Survey of Columbia River Basin Streams for Giant Columbia River Spire Snail, Fluminicola columbiana and Great Columbia River Limpet, Fisherola nuttalli*. PNL-7103, Pacific Northwest Laboratory, Richland, Washington.
- Neitzel, D.A., T.J. Frest, 1993. *Survey of Columbia River Basin Streams for Columbia Pebblesnail, Fluminicola columbiana and Shortface Lanx, Fisherola nuttalli*. PNL-8229, Pacific Northwest Laboratory, Richland, Washington.
- Newell, R.L., 1998. *Survey and Literature Review of Aquatic Invertebrates--The Hanford Reach of the Columbia River, Some Tributaries and Two Adjacent Springs, Washington State, U.S.A.* The Nature Conservancy of Washington, Seattle, Washington.
- Nisbet, J., 1999. *Singing Grass, Burning Sage: Discovering Washington's Shrub-steppe*. The Nature Conservancy of Washington, Seattle, Washington and Graphic Arts Center Publishing, Portland, Oregon.
- Noss, R.F., E.T. LaRoe III, and J.M. Scott, 1995. *Endangered Ecosystems of the United States: A Preliminary Assessment of Loss and Degradation. Biological Report 28*. U.S. Department of the Interior, National Biological Service, Washington, D.C.
- Nussbaum, R.A., E.D. Brodie, and R.M. Storm, 1983. *Amphibians and Reptiles of the Pacific Northwest*. University Press of Idaho, Moscow, Idaho.
- O'Farrell, T.P., 1972. "Ecological Distribution of Sagebrush Voles, *Lagurus curtatus*, in southcentral Washington," *Journal of Mammalogy*, 53:632-636.
- O'Farrell, T.P., 1973. *Project ALE: A Natural Desert Community*. Pacific Search.

Olson, D.H., and W.P. Leonard, 1997. "Amphibian Inventory and Monitoring: A Standardized Approach for the Pacific Northwest," in D. Olson, W.P. Leonard, and R.B. Bury (eds.), "Sampling Amphibians in Lentic Habitats: Methods and Approaches for the Pacific Northwest," *Northwest Fauna*, 4.

Pabst, R.J. (ed.), 1995. *Biodiversity Inventory and Analysis of the Hanford Site: 1994 Annual Report*. The Nature Conservancy of Washington, Seattle, Washington.

Pauley, G.B., 1968. "Tumor Incidence Among Freshwater Mussel Populations," in *Annual Report for 1967*. BNWL-714, Pacific Northwest Lab, Vol. 1. Biologica Sciences, Battelle, Richland, Washington.

Payne, N.F., G.P. Munger, J.W. Mathews, and R.D. Tabor, 1976. *Inventory of Vegetation and Wildlife in Riparian and Other Habitats Along the Upper Columbia River*. Volume 4a. Prepared for the U.S. Army Corps of Engineers, North Pacific Division, Portland, Oregon by the College of Forest Resources, University of Washington, Seattle.

Pearson, L.C., and S.K. Rope, 1987. *Lichens of the Idaho National Engineering Laboratory*. Department of Energy/ID-12110. Radiological and Environmental Sciences Laboratory, U.S. Department of Energy, Idaho Falls, Idaho.

Pacific Northwest Laboratory, 1977. *Procedures for the Administration of the Hanford National Environmental Research Park*. PNL-2445, Pacific Northwest Laboratory, Richland, Washington.

Pacific Northwest Laboratory, 1993. *Arid Lands Ecology (ALE) Facility Management Plan*. PNL-8506, Pacific Northwest Laboratory, Richland, Washington.

Pacific Northwest National Laboratory, 1997. *Climatological Data, January through June, Hanford Meteorology Station*. Pacific Northwest National Laboratory, Richland, Washington.

Porter, K.R., 1972. *Herpetology*. W.B. Saunders Company, Philadelphia, Pennsylvania.

Pyle, R.M., 1989. *Washington Butterfly Conservation Status Report and Plan*. Washington Department of Wildlife, Nongame Program, Olympia, Washington.

Ralph, C.J., G.R. Geupel, P. Pyle, T.E. Martin, and D.F. DeSante, 1993. *Handbook of Field Methods for Monitoring Landbirds*. General Technical Report PSW-GTR-144. U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station, Albany, California.

Richter, K.O., 1995. "A Simple Aquatic Funnel Trap and its Application to Wetland Amphibian Monitoring," *Herpetological Review*, (26)2:90-91.

Rickard, W.H., 1968. "Field Observations on the Altitudinal Distribution of the Side-blotched Lizard," *Northwest Science*, 42:161-164.

Rickard, W.H., 1972. "Rattlesnake Hills Research Natural Area," in J.F. Franklin, F.C. Hall, C.T. Dyrness, and C. Maser (eds.), *Federal Research Natural Areas in Oregon and Washington: A Guidebook for Scientists and Educators*. U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

Rickard, W.H., and C.E. Cushing, 1982. "Recovery of Streamside Woody Vegetation after Exclusion of Cattle Grazing," *Journal of Range Management*, 35: 300-301.

Rickard, W.H., and L.D. Poole, 1989. "Terrestrial Wildlife of the Hanford Site: Past and Future," *Northwest Science*, 63:183-193.

Rogers, L.E., and W.H. Rickard, 1977. *Ecology of the 200 Area Plateau Waste Management Environs: A Status Report*. PNL-2253, Pacific Northwest Laboratory, Richland, Washington.

Rogers, L.E., and W.H. Rickard, 1975. "A Survey of Darkling Beetles in Desert Steppe Vegetation after a Decade," *Annals of the Entomological Society of America*, 68:1069-1070.

Rogers, L.E., N. Woodley, J.K. Sheldon, and V.A. Uresk, 1978. *Darkling Beetle Populations (Tenebrionidae) of the Hanford Site in Southcentral Washington*. PNL-2465, Pacific Northwest Laboratory, Richland, Washington.

Rosentreter, R., 1986. "Compositional Patterns Within a Rabbitbrush (*Chrysothamnus*) Community of the Idaho Snake River Plain," in *Proc. Conf. Shrub Research Consortium*. U.S. Forest Service Interm. Res. Stat. General Technical Report.

Ryan, B.D., 1994. "East Side Lichen Report for Washington and Oregon," unpublished report of the Interior Columbia Basin Ecosystem Management Project. U.S. Forest Service and Bureau of Land Management.

Saab, V.A., and T.D. Rich, 1997. *Large-scale Conservation Assessment for Neotropical Migratory Land Birds in the Interior Columbia River Basin*. General Technical Report PNW-GTR-399. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, Oregon.

Sackschewsky, M.R., D.S. Landeen, G.I. Baird, W.H. Rickard, and J.L. Downs, 1992. *Vascular Plants on the Hanford Site*. WHC-EP-0554. Westinghouse Hanford Company, Richland, Washington.

Salstrom, D., and R. Easterly, 1995. *Riparian Plant Communities: South Shore and Islands of the Columbia River on the Hanford Site, Washington*. Report to The Nature Conservancy of Washington, Seattle, Washington.

Sarell, M.J., and K.P. McGuinness, 1993. *Rare Bats of the Shrub-steppe Ecosystem of Eastern Washington*. Report for the Washington Department of Wildlife. Opiuchus Consulting, Oliver, British Columbia.

Schwab, G.E., R.M. Colpitts, Jr., and D.A. Schwab, 1979. *Spring Inventory of the Rattlesnake Hills*. W.K. Summers and Associates, Inc., Socorro, New Mexico.

Sheldon, J.K., and L.E. Rogers, 1984. "Seasonal and Habitat Distribution of Tenebrionid Beetles in Shrub-steppe Communities of the Hanford Site in Eastern Washington," *Environmental Entomology*, 13:214-220.

Smith, G.W., and D.R. Johnson, 1985. "Demography of a Townsend's Ground Squirrel Population in Southwestern Idaho," *Ecology*, 66:171-178.

Smith, G.W., and N.C. Nydegger, 1985. "A Spotlight, Line-transect Method for Surveying Jack Rabbits," *Journal of Wildlife Management*, 49:699-702.

Smith, M.R., 1994. *Evaluating the Conservation of Avian Diversity in Eastern Washington: A Geographic Analysis of Upland Breeding Birds*. M.S. Thesis. University of Washington, Seattle.

Smith, M.R., P.W. Mattocks, Jr., and K.M. Cassidy, 1997. "Breeding Birds of Washington State. Volume 4 in K.M. Cassidy, C.E. Grue, M.R. Smith, and K.M. Dvornich (eds.), *Washington State Gap Analysis Final Report*. Seattle Audubon Society Publications in Zoology, No. 1., Seattle, Washington.

Soll, J., J.A. Hall, R. Pabst, C. Soper, (eds.), 1999. *Biodiversity Inventory and Analysis of the Hanford Site, Final Report: 1994-1999*. Prepared by The Nature Conservancy of Washington in partial fulfillment of U.S. Department of Energy Grant Award Number DE-FG06-94RL12858.

Soll, J.A., and C. Soper (eds), 1996. *Biodiversity Inventory and Analysis of the Hanford Site: 1995 Annual Report*. The Nature Conservancy of Washington, Seattle, Washington.

St. Clair, L.L., B.L. Webb, J.R. Johansen, and G.T. Nebeker, 1984. "Cryptogamic Soil Crusts: Enhancement of Seedling Establishment in Disturbed and Undisturbed Areas," *Reclamation and Revegetation Research*, 3: 129-136.

Stebbins, R.C., and N. Cohen, 1995. *A Natural History of Amphibians*. Princeton University Press, Princeton.

Stepniewski, A.M., 1995. *Birds of the North Slope (Saddle Mountain NWR/Wahluke Wildlife Area): Hanford Site Biodiversity Inventory*. The Nature Conservancy of Washington, Seattle, Washington.

Stepniewski, A.M., 1996. *Birds of the North Slope (Saddle Mountain NWR/Wahluke Wildlife Area): Hanford Site Biodiversity Inventory*. The Nature Conservancy of Washington, Seattle, Washington.

Taylor, D.W., 1975. "Index and Bibliography of Late Cenozoic Freshwater Mollusca of Western North America," *Claude W. Hubbard Memorial Volume 1*. Museum of Paleontology, University of Michigan, No. 10:1-384.

The Nature Conservancy of Washington, 1998. *The Columbia River's Hanford Reach and North Slope Lands*.

Thomas, D.W., and S.D. West, 1989. *Sampling Methods for Bats*. General Technical Report PNW-GTR-243. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, Oregon.

U.S. Department of Energy, 1994. "National Environmental Research Parks," DOE/ER-0615P, Office of Energy Research, Washington, D.C.

U.S. Department of Energy, 1996. "Draft Hanford Site Biological Resources Management Plan," DOE/RL 96.32, Rev.0. Richland Operations Office, Richland, Washington.

U.S. Department of Energy, 1999. "Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement: Summary," Richland Operations Office, Richland, Washington.

U.S. Department of Energy, 1999. "Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement," Richland Operations Office, Richland, Washington.

U.S. Department of the Interior, Fish and Wildlife Service, 1980. "Important Fish and Wildlife Habitat of Washington: An Inventory," Fish and Wildlife Service, Portland, Oregon

U.S. Department of the Interior, Fish and Wildlife Service, 1998. "Endangered, Threatened, Proposed and Candidate Species, Species of Concern, and Critical Habitat in Eastern Washington," Fish and Wildlife Service, Upper Columbia River Basin Field Office, Spokane, Washington.

U.S. Department of the Interior, National Park Service, 1994. "The Hanford Reach of the Columbia River: Final River Conservation Study and Environmental Impact Statement," National Park Service, Seattle, Washington.

Vander Haegen, M., 1996. *Survey of Breeding Communities on BRMaP Sites, Hanford Site, 1996*. Project Completion Report ITF No. 244058-A-B3. Washington Department of Fish and Wildlife, Wildlife Management Program Research Division, Olympia, Washington.

Wake, D.B., and H.J. Morowitz, 1991. "Declining Amphibian Populations—A Global Phenomenon? Findings and Recommendations," Report to Board on Biology, National Research Council, on workshop in Irvine, California 19-20 February 1990; reprinted 1991. *Alytes* 9:33-42.

Washington Department of Fish and Wildlife, 1998. *State Listed Species, State Candidate Species, and State Monitor Species List*. Wildlife Management Program, Olympia, Washington.

Washington Department of Natural Resources, 1995. *State of Washington Natural Heritage Plan: 1993/1995/1998 Update*. Washington Natural Heritage Program, Olympia, Washington.

Weiss, N.J., and B.J. Verts, 1984. "Habitat and Distribution of Pygmy Rabbits (*Sylvilagus idahoensis*) in Oregon," *Journal of Mammalogy*, 44:5563-571.

Welsh, S.L., F. Caplow, and K. Beck, 1997. "New variety of *Astragalus conjunctus* S. Watson from Benton County, Washington," *Great Basin Naturalist*, 57:352-354.

West, S.D., R. Gitzen, and J.L. Erickson, 1998. *Hanford Vertebrate Survey: Report of Activities for the 1997 Field Season*. Report to The Nature Conservancy of Washington.

West, S.D., R. Gitzen, and J.L. Erickson, 1999. *Hanford Vertebrate Survey: Report of Activities for the 1998 Field Season*. Report to The Nature Conservancy of Washington.

Wilderman, D., 1994. *Plant Communities of the Fitzner/Eberhardt Arid Lands Ecology Reserve and the North Slope of the Hanford Site*. The Nature Conservancy of Washington, Seattle, Washington.

Washington Natural Heritage Program, 1997. *Endangered, Threatened & Sensitive Vascular Plants of Washington with Working Lists of Rare Non-vascular Species*. Washington Department of Natural Resources, Forest Resources Division, Olympia, Washington.

Wolf, E.G., and C.E. Cushing, 1972. "Productivity of Rattlesnake Springs, in *Pacific Northwest Laboratory Annual Report for 1971*, BNWL-1650 PT2, Vol. 1. Life Sciences, Part 2 Ecological Sciences, Battelle, Richland, Washington.

Zack, R.S., and C.N. Looney, 1998. *Biological Diversity Inventory and Analysis at the Hanford Site Insects*. Report to The Nature Conservancy of Washington.

Zack, R.S., 1996. *Biological Diversity Inventory and Analysis at the Hanford Site Insects*. Report to The Nature Conservancy of Washington.

Zack, R.S., 1995. *Biological Diversity Inventory and Analysis at the Hanford Site Insects*. Report to The Nature Conservancy of Washington.

Zack, R.S., 1994. *Biological Diversity Inventory and Analysis at the Hanford Site Insects*. Report to The Nature Conservancy of Washington.

Zack, R.S., and D.L. Streng, 1998. *Entomological Diversity Inventory and Analysis at the Hanford Site: Report for the 1997 Field Season*. Report to The Nature Conservancy of Washington.